CLAIMS

1. A bulky sheet comprising a fiber aggregate formed by water needling of a fiber web, said bulky sheet having a number of projections and depressions comprising said fiber aggregate, said projections and said depressions being formed both by rearrangement of the constituting fibers of said fiber aggregate by water needling of said fiber aggregate and by the multiple bending manner of said fiber aggregate along the thickness direction thereof, and said projections and said depressions retaining the shape thereof by themselves.

2. A bulky sheet comprising a fiber aggregate formed by water needling of a fiber web and a network sheet, said bulky sheet having a number of projections and depressions comprising said fiber aggregate, the constituting fibers of said fiber aggregate which are entangled with each other by said water needling are further entangled with and/or thermally bonded to said network sheet thereby forming a unitary body, said projections and said depressions being formed both by rearrangement of the constituting fibers of said fiber aggregate by water needling of said fiber aggregate and by the multiple bending manner of said fiber aggregate along the thickness direction thereof, and said projections and said depressions retaining the shape thereof by themselves.

3. The bulky sheet according to claim 1, having an apparent thickness of 1 to 5 mm, and an apparent volume of 23 to 100 cm^3/g.

4. The bulky sheet according to claim 1, having an elongation of 5% or less in the machine direction thereof measured under the condition of 5N/30mm.

5. The bulky sheet according to claim 1, wherein said fiber aggregate contains fibers having a fineness of 5 dtex or less at an amount of 50 % by weight or more, and has a basis weight of 30 to 100 g/m^2.

6. A process for producing the bulky sheet according to claim 1 comprising the steps of:

water needling a fiber web to entangle the constituting fibers of said fiber web with each other thereby forming a fiber aggregate;

transferring said fiber aggregate onto a patterning member having a number of depressions and projections or a number of perforations; and

projecting part of said fiber aggregate into said depressions or said perforations to form a number of projections corresponding to said depressions or said perforations,

said patterning member having a thickness of 5 to 25 mm, or having an air permeability of 800 to 3000 $cm^3/(cm^2sec)$,

the energy Em and the energy Ef are applied to said fiber web and said fiber aggregate, respectively, in such a manner that the energy Em and the energy Ef satisfy at least one of the following formulae:

$$200\ (kJ/kg) < Em+Ef < 1250\ (kJ/kg)$$

$$Em/10 < Ef < 2Em/3$$

wherein Em is an energy which is applied to said fiber web to form said fiber aggregate by said water needling, and Ef is an energy which is applied to said fiber aggregate to project part of said fiber aggregate on said patterning member.

7. The process according to claim 6, wherein the constituting fibers of said fiber web are entangled with each other by said water needling thereby forming such a fiber aggregate as to have an entanglement coefficient of 0.05 to 2.0 N·m/g

8. A process for producing the bulky sheet according to claim 2 comprising the steps of:

water needling a fiber web to entangle the constituting fibers of said fiber web with each other thereby forming a fiber aggregate;

superposing said fiber aggregate on one side or both sides of a network sheet and partially thermally bonding said constituting fibers to said network sheet thereby forming a unitary body;

transferring said fiber aggregate onto a patterning member having a number of depressions and projections or a number of perforations; and

projecting part of said fiber aggregate into said depressions or said perforations to form a number of projections corresponding to said depressions or said perforations,

said patterning member having a thickness of 5 to 25 mm, or having an air permeability of 800 to 3000 $cm^3/(cm^2sec)$,

the energy Em and the energy Ef are applied to said fiber web and said fiber aggregate, respectively, in such a manner that the energy Em and the energy Ef satisfy at least one of the following formulae:

$$200\ (kJ/kg) < Em+Ef < 1250\ (kJ/kg)$$

$$Em/10 < Ef < 2Em/3$$

wherein Em is an energy which is applied to said fiber web to form said fiber aggregate by said water needling, and Ef is an energy which is applied to said fiber aggregate to project part of said fiber aggregate on said patterning member.

9. The bulky sheet according to claim 2, wherein said bulky sheet has not been subjected to heat shrinking of said network sheet, or said network sheet has a heat shrinkage of 3% or less as measured under 140°C for 3 minutes.

10. The bulky sheet according to claim 1, having a breaking strength of at least 5 N at the width of the specimen of 30mm.